BI Performance Through Purpose-built Analytical Databases

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Agenda

- Today's Biggest Challenge in BI - Performance
- Common Approaches Used For Database Performance
- New Breakthrough: On-Chip Computing/ Columnar Design
- Vectorwise – A Purpose-Built Analytical Database
- Illustrative Use Cases

Today's Challenges in BI

Make informed decisions faster

Analysis in seconds not minutes, minutes not hours

Data explosion & Big Data

Collecting more information, less resources
>44x growth in next 10 years

Existing Tools:
Too Slow. Too complex. Too expensive.

Analytical databases designed in 80s & 90s do not take advantage of today's modern hardware

Biggest BI Challenge - SPEED

What Problem will eventually drive you to replace your current data warehouse platform?

1. Poor Query Response **45%**

2. Can't Support Advanced Analytics **40%**

Source: TDWI Q4 2009 Best Practices Report

"Gartner clients increasingly report performance constrained data warehouses during inquires. Based on these inquiries, we estimate that nearly 70% of data warehouses experience performance-constrained issues of various types."

Source: Gartner Magic Quadrant for Data Warehouse Database Management Systems, Jan 2010

Biggest BI Challenge - SPEED

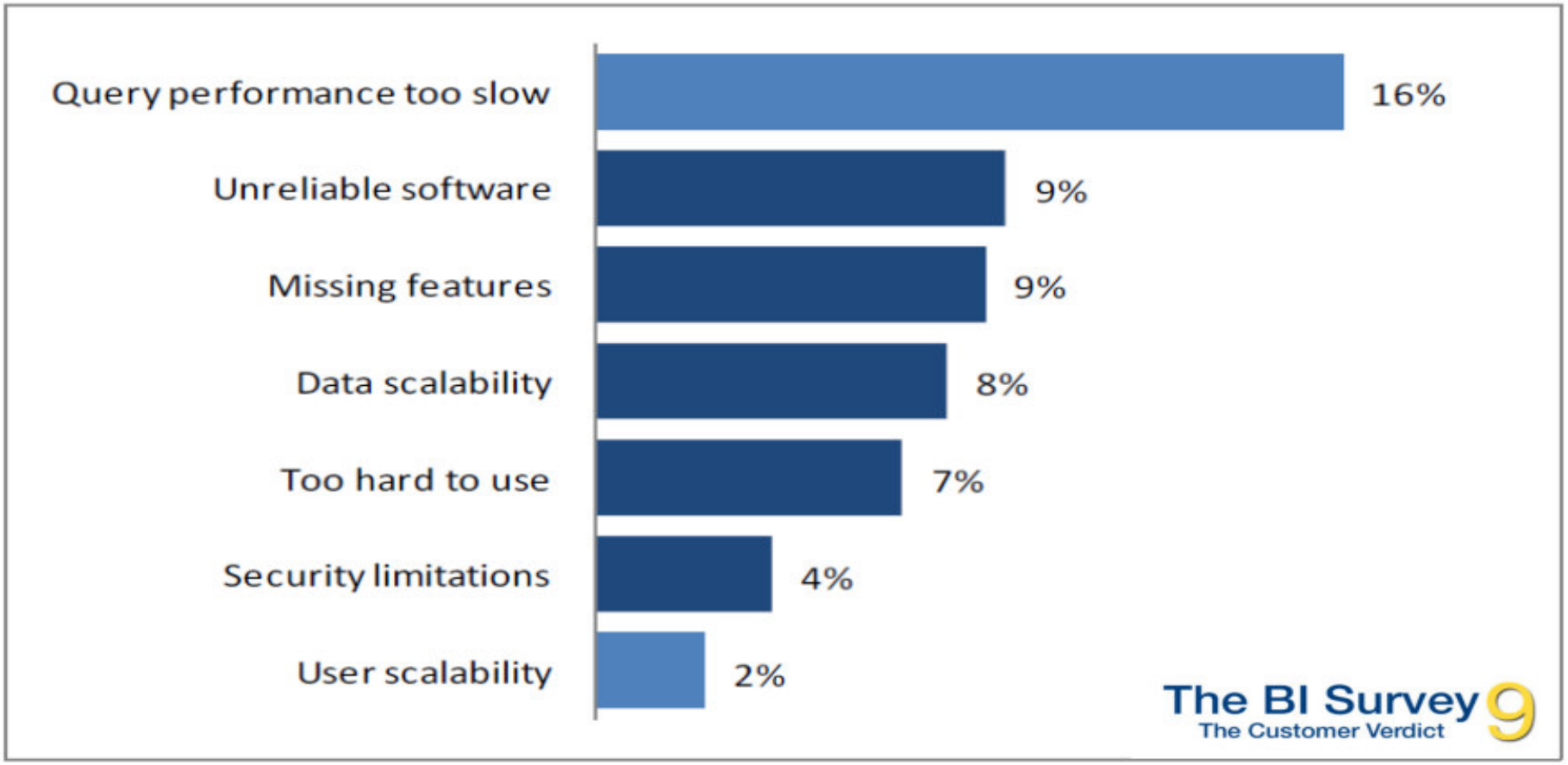


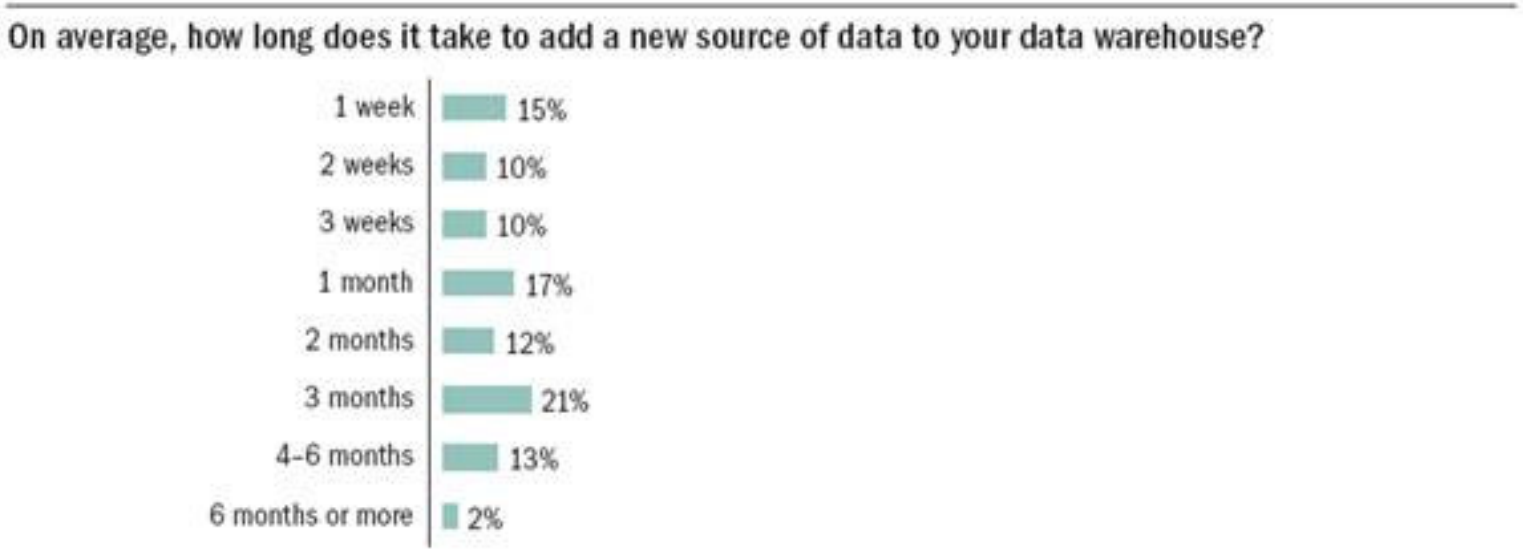
Figure 150: Performance problems (in lighter blue) compared to other product-related problems

Source: 2010 BI Survey 9 – World's largest independent BI Survey 3093 respondents

Cubes and Speed

As cubes grow in size they take longer to load and build

- Processing time might exceed batch window
- Difficulty managing large cubes
- Time required to add new dimensions



Average time to add a new data source

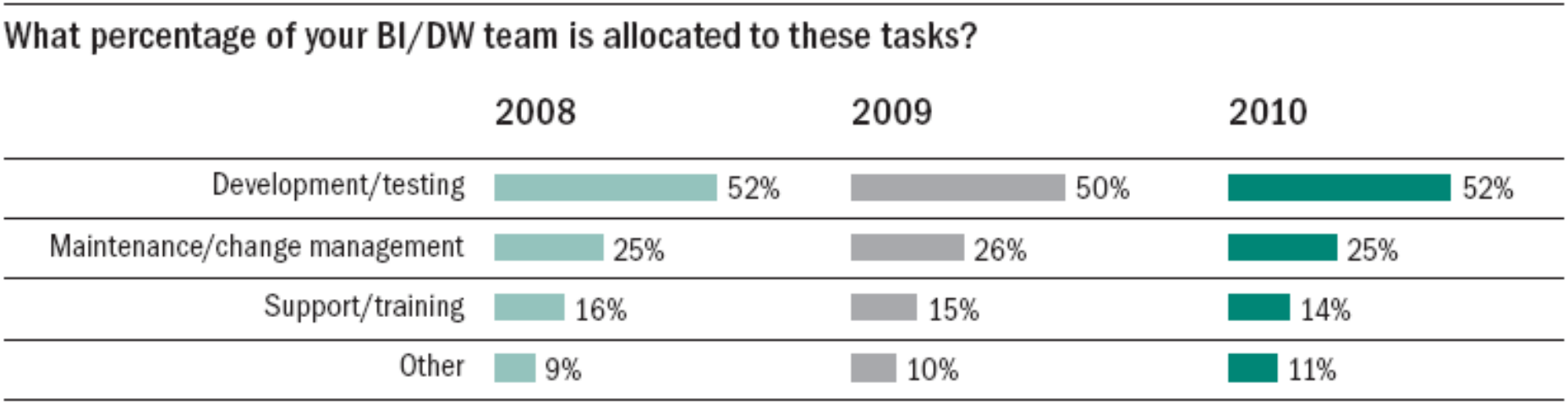
2008	7.0 weeks
2009	8.4 weeks
2010	7.4 weeks

Source: 2010 TDWI Benchmarks

Relational Databases and Speed

Limitations in SQL technology

- Adhoc queries too slow
- Indexing/Aggregations cost time & money
- 25% average BI/DW team time used up for maintenance/change management



Source: 2010 TDWI BI Benchmark Report

Challenges with Current State of BI

Business Wants Faster Answers

Application

Data Growth Exponential

Database Too Slow

Traditional Database

Analytical Bottleneck

Complex, Risky & Expensive


OLAP Cubes


Indices


Rollups


Star Schemas


Tuning

DB only use a fraction of CPU Capability

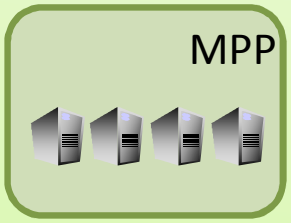
More Hardware

Hardware

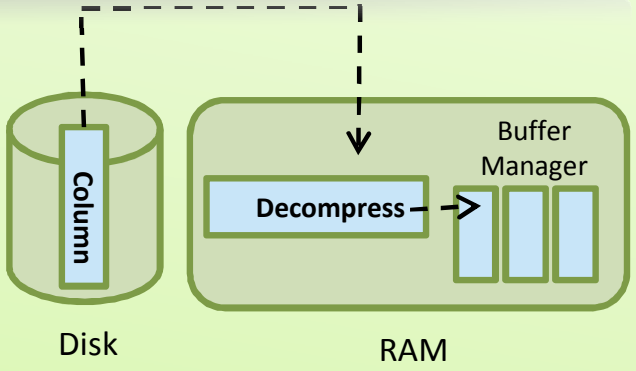
Approaches Used for Achieving Database Performance

Optimizations for parallel processing and minimal data retrieval

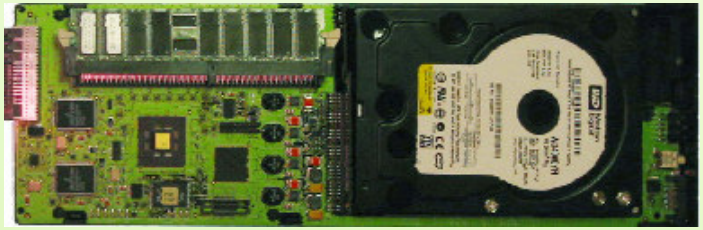
Parallel Processing



Column store with compression



Proprietary hardware



Data Warehouse Appliances

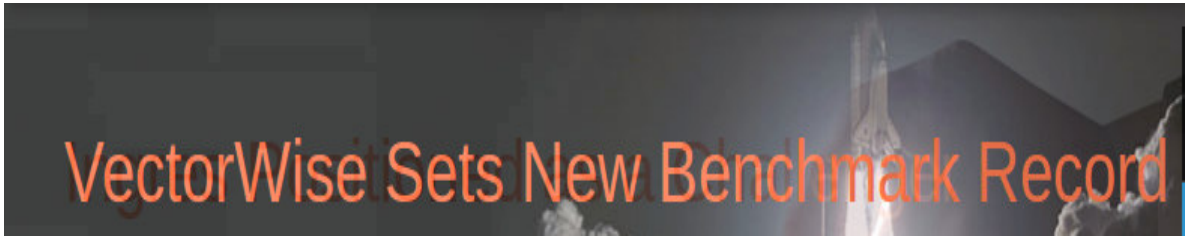
Acceptable performance has been achieved by using more hardware or by intelligently lowering the volume of data to be processed

However, none of these approaches leverages the performance features of today's CPUs i.e. taking the most out of each modern commodity CPU

New Breakthrough Vectorwise Analytical Database

Purpose-Built Analytical Relational database for BI and data analysis

- **Runs blazing fast/interactive data analysis**
- **Exploits performance potential in today's CPUs**
- **Delivers in-memory performance without being memory constraint**



*"**Game-changing** technology."*
Don Feinberg, Gartner Group

*"This is definitely a breakthrough. It delivers **faster results at lower costs.**"*
Noel Yuhanna, Forrester Research

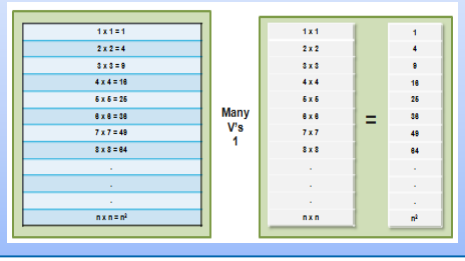
"This inevitability puts VectorWise 4 years ahead of the competition in terms of performance – and it will remain 4 years ahead until some competitor finds a way to catch up at a software level. This is unprecedented."

Robin Bloor, The Virtual Circle

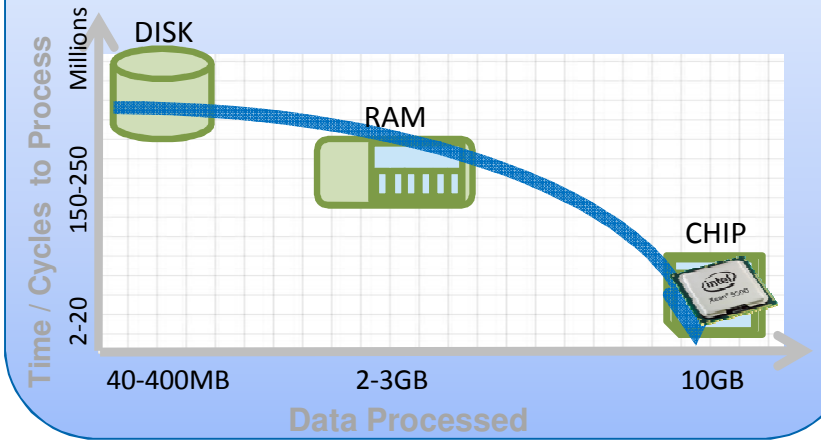
Vectorwise:
On Chip Computing/Columnar Database

Breakthrough technology

Vector Processing

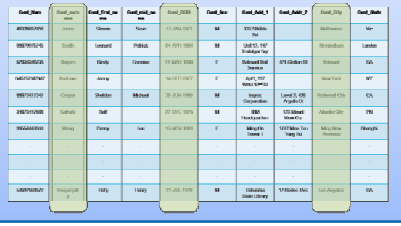


On Chip Computing

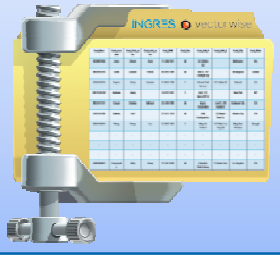


Innovations on proven techniques

Updateable Column Store

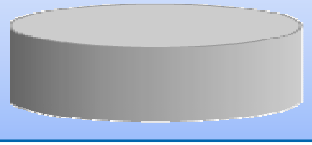


Automatic Compression



Automatic Storage Indexes

Minimize IO



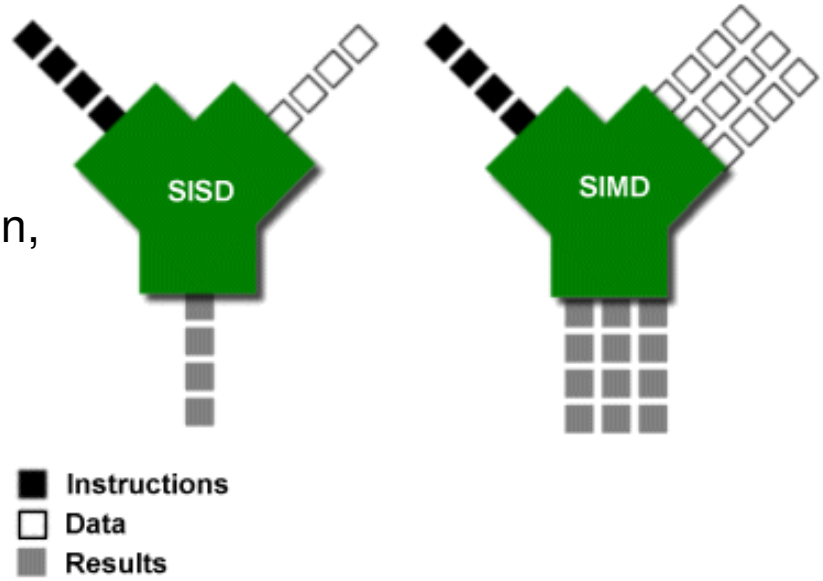
Parallel Processing

Vectorwise Technology

- **Vector processing**
  - Exploits super-scalar features using SIMD capabilities of today's CPUs
- **Optimizes memory hierarchy**
  - Maximizes use of CPU cache
  - Fewer requests to RAM and disk
- **Data Compression/De-Compression**
  - Optimized compression enabling very fast de-compression for overall performance enhancement
  - Vectorized de-compression
  - Automatic compression through ultra-efficient algorithms
- **Automatic Indexing**
  - System generated Storage Indexes
  - Easy identification of candidate data blocks for queries
- **Integration**
  - Standard SQL and interfaces
  - Common BI/Data Integration tools

Modern CPU Instruction Capabilities

- **SIMD**
  - Traditional CPU processing: Single Instruction, Single Data (SISD)
  - Modern CPU processing capabilities: Single Instruction, Multiple Data (SIMD)
- **Out-of-order execution**
- **Chip multi-threading**
- **Large L2/L3 caches**
- **Streaming SIMD Extensions for efficient SIMD processing**
- **Hardware accelerated String Processing**



Vector Processing

One operation performed on one element at a time

Large overheads

Traditional Scalar Processing

1 x 1 = 1
2 x 2 = 4
3 x 3 = 9
4 x 4 = 16
5 x 5 = 25
6 x 6 = 36
7 x 7 = 49
8 x 8 = 64
.
.
.
n x n = n^2

Many V's 1

Vector Processing

1 x 1	=	1
2 x 2		4
3 x 3		9
4 x 4		16
5 x 5		25
6 x 6		36
7 x 7		49
8 x 8		64
.		.
.		.
.		.
n x n		n^2

One operation performed on a set of data at a time

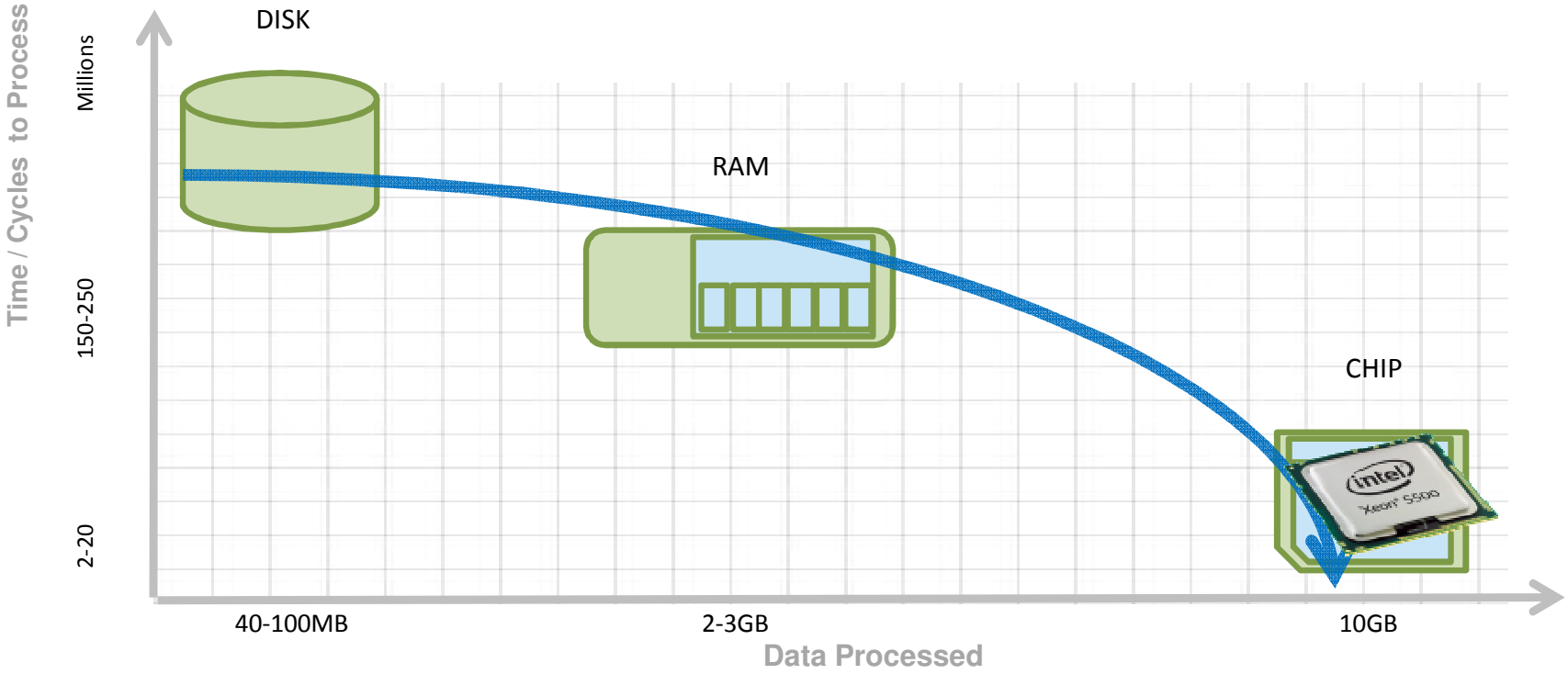
No overheads

Process even 1.5GB per second

Processing in Chip Cache

GB/s	Measure of Throughput
Cycles	Amount of CPU time required to process data

Using CPU cache is far more faster & efficient



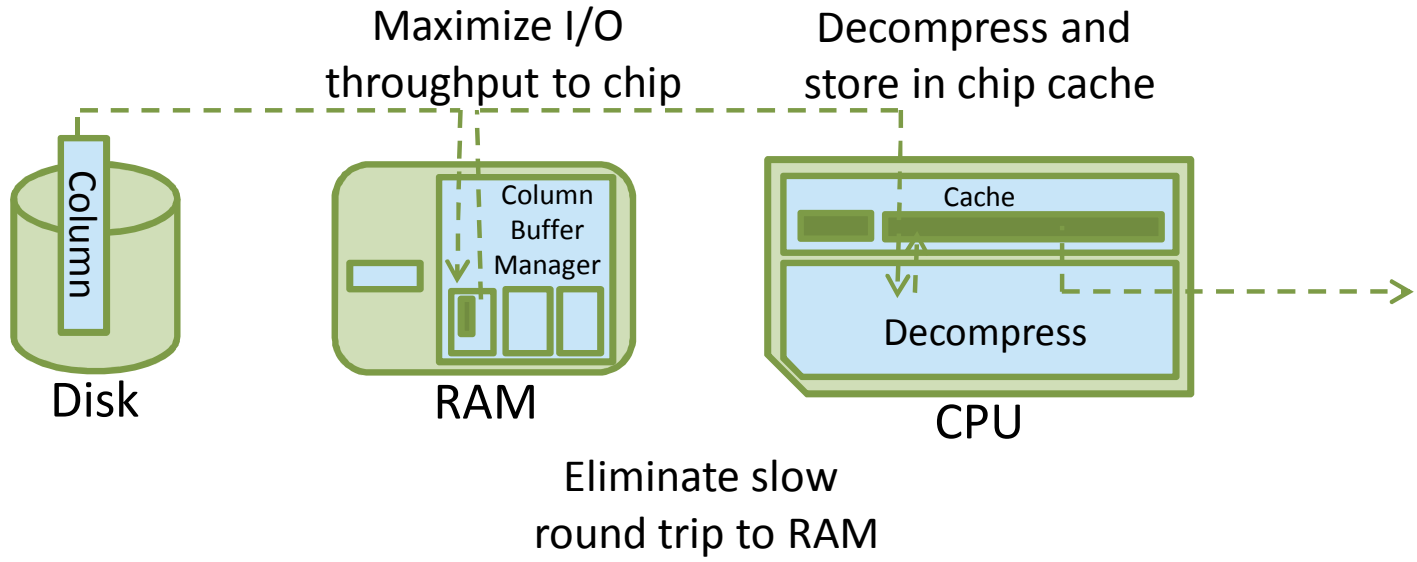
Updateable Column Store

- **Only access relevant data**
- **Enable incremental updates efficiently**
  - Traditionally a weakness for column-based stores

Cust_Num	Cust_surname	Cust_first_name	Cust_mid_name	Cust_DOB	Cust_Sex	Cust_Add_1	Cust_Addr_2	Cust_City	Cust_State
46328927956	Jones	Steven	Sean	17-JAN-1971	M	333 StKilda Rd		Melbourne	Vic
98679975745	Smith	Leonard	Patrick	04-APR-1964	M	Unit 12, 147 Trafalgar Sqr		Birmingham	London
52634346735	Rogers	Cindy	Carmine	11-MAR-1980	F	Belmont Rail Service	421 Station St	Belmont	CA
346737347347	Andrews	Jenny		14-SEP-1977	F	Apt1, 117 West 42nd St		New York	NY
88673477347	Cooper	Sheldon	Michael	30-JUN-1980	M	Ingres Corporation	Level 2, 426 Argello St	Redwood City	CA
34673447568	Kollwitz	Rolf		22-DEC-1975	M	IBM Headquarters	123 Mount View Crs	Atlantic City	PN
99554443044	Wong	Penny	Lee	13-NOV-1981	F	Ming On Tower 1	1777 Moa Tzu Tung Rd	Ming Now Province	Shanghi

Optimized Compression & Fast De-Compression

- **Column-based compression with multiple algorithms**
  - Automatically determined by VectorWise
- **Vectorised decompression**
  - Only for data processing in CPU cache



Storage Index

- Always automatically created
- Automatically maintained
- Stores min/max value per data block
- Enables database to efficiently identify candidate data blocks

Vectorwise Features

Performance

- 10x-75x faster for BI, analytics & reporting
- In-memory performance without memory restraints
- Near real-time updatable database
- Delivers results in seconds not minutes minutes not hours

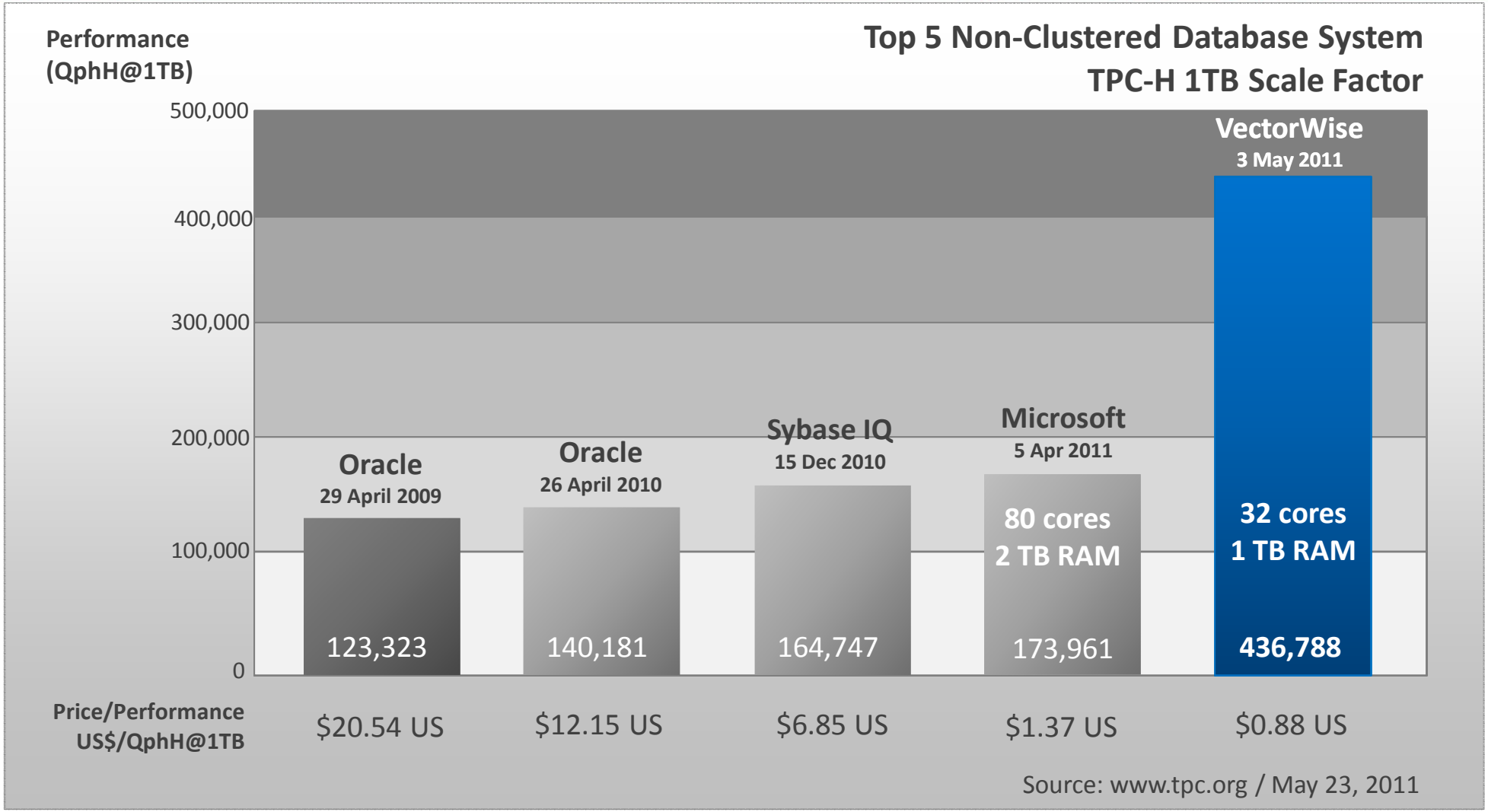
Usage & Integration

- Uses ANSI standard queries & SQL statements
- Eliminate/reduce Cubes, aggregate tables, roll ups, indexes….
- Self indexing & self tuning database
- Deliver BI projects faster with lower cost & risk

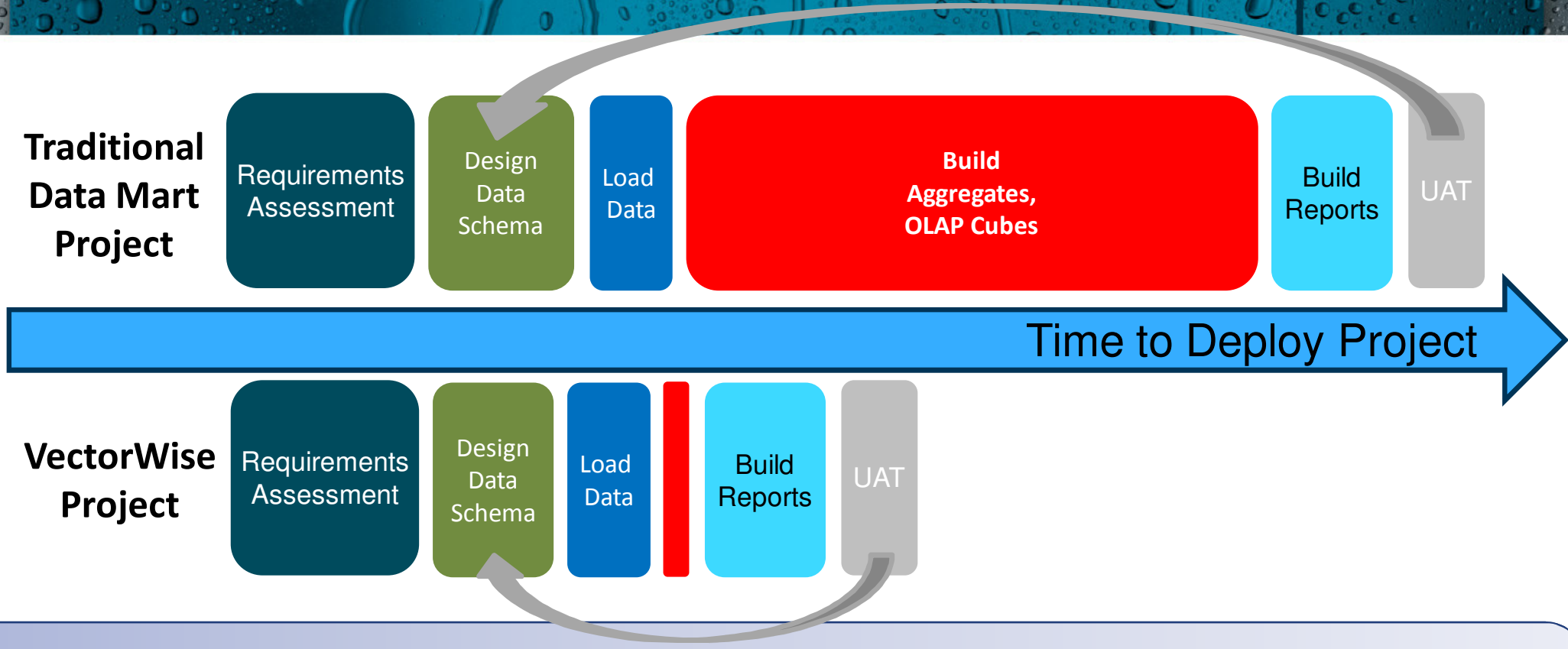
TCO

- Maximize utilization of CPUs in low cost commodity hardware
- Handle tens of terabytes scale data with a single server
- Requires commodity hardware
- Does not require MPP

TPC-H Benchmark Results – 1TB
<½ Hardware, >2.5x Performance



Vectorwise
BI Tuning & Complexity

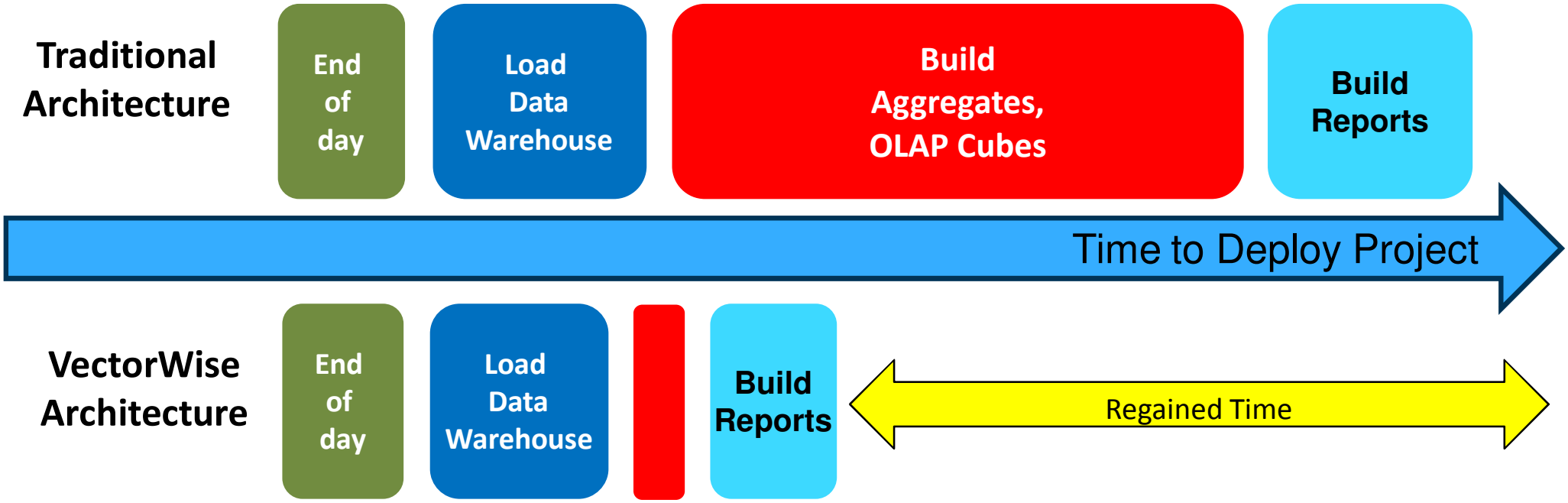


2010 TDWI BI Benchmark Report
Average time to build a complex report or dashboard
(20 dimensions, 12 measures, and 6 user access roles)

2008	6.7 weeks
2009	6.3 weeks
2010	6.6 weeks

Vectorwise
BI Tuning & Complexity

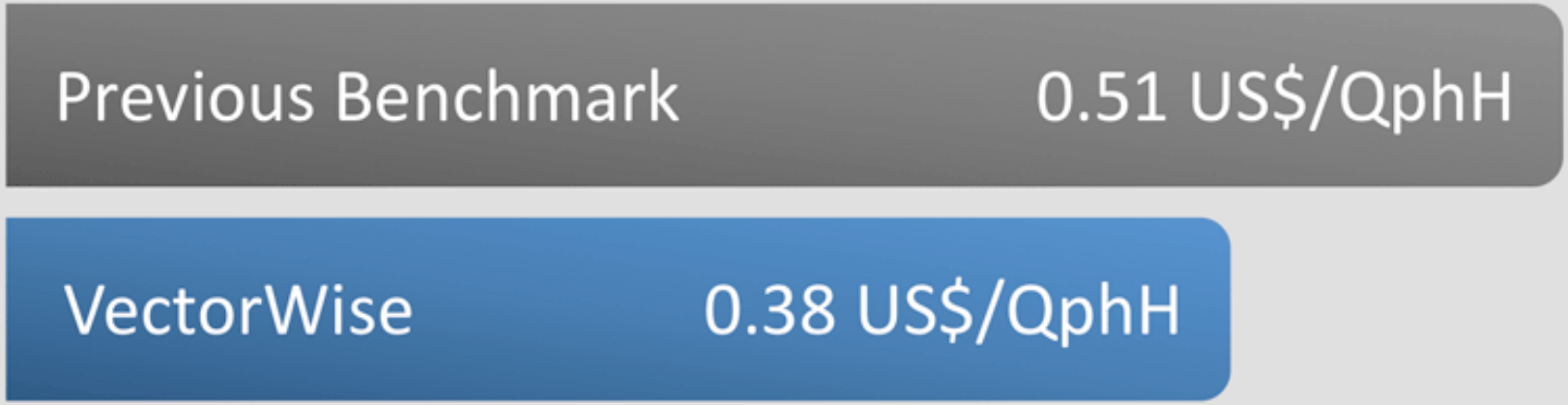
Fast Processing Everyday!!!



Price/Performance

Price/Performance Benchmarks TPC-H 100GB Scale Factor

Non-Clustered Results - Price / Composite queries per hour (QphH)



25.5% better price/performance than previous-benchmark record holder

Source: www.tpc.org / February 15, 2011

Analytical Databases - Illustrative Use Cases

Telcos/VAS	Retail	FSI	Web 2.0
Store & analyze CDR, VAS downloads & other subscriber/network data for: - Revenue assurance - Price optimization - Customer loyalty/churn - Marketing effectiveness - Service level effectiveness - Network performance	Store & analyze data for: - Customer loyalty - Buying behavior - Marketing effectiveness - SKU level analysis	Store & analyze transaction, market & customer data for: - Risk management & compliance - Quantitative analysis of financial models - Claims data analysis - Fraud detection - Credit rating - Marketing effectiveness	Store & analyze data for: - Weblog data - Online behavior - Buying behavior - Marketing effectiveness

Healthcare & Biotech	Transportation	Manufacturing	Government
Store & analyze data for: - Patient data records - Clinical data analysis - Drug discovery & development analysis	Store & analyze data for: - Passenger traffic data - Customer behavior - Customer loyalty - Marketing effectiveness	Store & analyze data for: - Supply chain - Product quality - Strategic procurement	Store & analyze data for: - Fraud detection - Cyber security - Immigration control

Vectorwise
Illustrative Real-world Use Cases

- **Financial Services**
  - **Hedge fund - Risk management in position analysis**
  - **Bank - Risk management & compliance reporting, Interactive BI/Analytics Platform**
- **Telecom**
  - **3G operator - CDR analysis for better customer insight and cross/upsell**
  - **BSS solutions provider - Telecom analytics**
- **Web 2.0/Social Media**
  - **Social media portal – Analyzing user traffic analysis for better targeted advertising**
  - **Freight exchange – Customer behavior analytics**
- **Retail**
  - **Data aggregator – Customer and infomercial analytics**
  - **Solution provider – Retail analytics**
- **Energy**
  - **Services provider to Utilities – Cloud-based smart metering solution**
- **Govt.**
  - **Tax authority – Tax compliance analysis**

More Information

www.actian.com/products/vectorwise

SkyInsight

Vectorwise Cloud Data Analytics

LinkedIn

VectorWise LinkedIn User Group